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STATE DOCUMENTS

PLANNING SURVEY WORK PROGRAM

AND

ESTIMATE OF EXPENDITURES

FOR THE FISCAL YEAR

JULY 1, 1970 - JUNE 30, 1971

PROJECT HPR-1(9)

MONTANA STATE HIGHWAY COMMISSION

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

BUREAU OF PUBLIC ROADS

Submitted June 5, 1970

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Federal Highway Administration 00-44.3
August 27, 1970
Page 2

Item E-11 Revision of Milepost Locations on Interstate System

Summary:

This project will revise existing mileposts that are now incorrectly located due to route relocations. It will also cover the cost of installing mileposts on about 150 miles of completed sections on the Interstate System that have not been covered by contract. These markers are used in reporting accidents and as a common denominator in our data bank. It is therefore essential that they be located within reasonable accuracy.

Approved Estimate: 1971 FY:

The Traffic Engineering Section will compute and mark the locations and Maintenance Forces will relocate and erect the milepost markers as necessary. Markers will be fabricated in our sign shop.

Estimated Cost:

Estimated Cost 1971 FY \$10,000

We have requested our Project Control Section to prepare the necessary program documents to revise project E-11(2) by \$80,000 to cover the cost of these new items.

Your early approval of this program revision will be appreciated.

Very truly yours,

W. IS R. CHETIM, P.E.,
State Highway Engineer

By
Paul R. DeVine
Planning Survey Director

PRD/vs

UNITED STATES GOVERNMENT

U.S. DEPARTMENT OF TRANSPORTATION

Memorandum RECEIVED

FEDERAL HIGHWAY ADMINISTRATION
222 S. W. Morrison Street
Portland, Oregon 97204

SEP 28 1970

HELENA, MONTANA

26-PRD

TO : Montana State Highway Commission
THROUGH: Mr. H. N. Stewart
Division Engineer
Helena, Montana

DATE: September 23, 1970

In reply refer to: 08-00.313

FROM : T. Dec, Chief
Planning and Research Division
Portland, Oregon

SUBJECT: Montana HPR-1(9) Planning
Work Program Revision

Conditional approval and authorization to proceed, effective September 8, 1970, with the work program revision submitted with Mr. DeVine's August 27, 1970 letter was issued on September 14, 1970. The work program revision and cost estimate are hereby approved subject to the availability of funds.

The revision provides for the addition of two items to Part I, Planning:

Item P-43, Inventory of Safety Features on Completed Four Lane Sections of Interstate System, \$70,000.

Item P-44, Revision of Milepost Locations on Interstate System, \$10,000.

The total estimated cost is \$80,000, including \$65,000 in Federal Funds, and is to be covered by a program revision in that amount.

cc: (3) Office of Planning (33-20) w/9-14 memo & attachments



RETURN TO M & F	MAY BE RETAINED	STATE HWY. ENG.	CHIEF COUNSEL	ASST. S.H.E. ADMS.	ACCOUNTING	PLANNING DIVISION	ASST. S.H.E. ENGR.	BRIDGE	PRECONSTRUCTION	RIGHT OF WAY	ASST. S.H.E. ENGR.	CONSTRUCTION	MAINTENANCE	MATERIALS	OTHER

BUY U.S. SAVINGS BONDS REGULARLY ON THE PAYROLL SAVINGS PLAN

FOREWARD

PART I PLANNING

Enabling legislation for establishing Planning Survey Sections in all 48 of the existing states was contained in the Hayden-Cartwright Act, which was passed by Congress in 1934. This act provided that up to one and one-half percent of all Federal Aid funds allocated to the states for highway construction could and should be used for highway planning purposes. These funds were to be matched by the states at the prevailing ratio designated for Federal Aid construction projects.

The Montana State Highway Planning Survey was established by the State Highway Commission when an agreement with the Bureau of Public Roads was formally approved on January 30, 1936.

This agreement specified that "The Highway Department under the advice and direction of the Bureau of Public Roads shall conduct state-wide investigations and shall make surveys, prepare plans and assemble engineering, economic and other data deemed necessary for the general planning of a complete highway system and program of highway improvements in the State."

The early years of the Planning Survey's existence were necessarily devoted primarily to the collection of data which could be used as input to the various planning processes rather than in actual planning. Traffic data were collected for the first time on a systematic basis and maps of various kinds were uniformly produced for every county and city in the State. Studies and investigations were also conducted to determine the characteristics of highway transport and to develop information concerning the collection and disbursement of taxes for highway purposes by the

State and its subdivisions.

During the last few years, more emphasis has been placed on overall transportation planning rather than in just gathering and accumulating basic data. The Planning Survey Section is still the repository of current, basic data required by the other sections and divisions of the State Highway Commission in day-to-day planning operations. In addition to the service provided to other sections of the department, the Planning Survey Section has begun to function as a comprehensive planning unit which has as its goal the utilization of all available planning data and techniques in the development of long range transportation plans for both urban and rural areas. To attain this goal our work program for Fiscal 1971 is oriented toward the following basic objectives.

1. To classify all roads and streets within the State as to function rather than jurisdiction and to estimate costs required to bring each functional class up to present standards.

2. To maintain a current and adequate record on all roads and streets including information on the physical and operational characteristics, present sufficiency, construction priorities and projected cost of improvements.

3. To forecast volumes and patterns of traffic based on forecasts of land use, population and economic factors.

4. To assign forecasted traffic volumes to a synthesized highway network to determine how a particular improvement will handle projected traffic volumes.

5. To propose and test various alternates to the transportation system and provide estimates of the use, cost and benefits so that policy



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decisions may be made on a factual basis.

All of these objectives will not be achieved during the next fiscal year and to achieve any of them will require close cooperation with all departments within the State Highway Commission as well as with other State and Federal agencies.

STATE OF MONTANA

HPR 1 (9)

WORK PROGRAM

1971 FISCAL YEAR

PART I

PLANNING

ESTIMATE OF ACTIVITIES AND
EXPENDITURES OF PLANNING SURVEY SECTION
FOR THE PERIOD OF JULY 1, 1970 - JUNE 30, 1971

HPR-1(9)

PART ONE - PLANNING ACTIVITIES

Administration and Control (Volume 1 Chapter II)
Item P-1 - Undistributed Overhead (Participating)

Objectives:

To finance work program management and administrative activities related to planning.

Accomplishments 1970 FY:

The following activities were financed under this item.

1. A substantial part of the salaries of the Planning Survey Director, his assistant, secretarial staff and accountant.
2. The cost of supplies and materials that cannot be separately identified and charged to specific projects.
3. Salaries and expenses of Planning Survey personnel attending Bureau of Public Roads approved meetings and workshops.

Proposed Activities 1971 FY:

It is proposed to finance substantially the same activities during the next fiscal year.

Estimated Cost:

Programmed 1970 FY	\$35,000
Estimated Expenditures 1970 FY	36,000
Estimated Cost 1971 FY	37,000

ROAD INVENTORY

Rural and Urban (Volume 2 Chapter I)
Item P-2

Objectives:

A complete re-inventory of every county road and city street in the State on a six year cycle. The information obtained is coded for IBM data processing and is used for various reports on the local system.

Accomplishments 1970 FY:

The following 12 counties were completely re-inventoried.

Broadwater	Gallatin	Meagher
Chouteau	Hill	Powell
Custer	Lewis & Clark	Prairie
Fallon	Liberty	Stillwater

Field contacts were made with the County Commissioners or county engineers in the other 44 counties to obtain data on the amount and type of road construction completed during the year. Other road building agencies in the State were also contacted to obtain current road data on their respective systems. These data were used to update road inventory files in the counties that were not inventoried.

All of the incorporated cities in the State were contacted concerning the amount and type of city streets that were constructed during the year and any changes that may have occurred in the corporate limit lines.

Proposed Activities 1971 FY:

It is planned to re-inventory the following 11 counties.

Carter	McCone	Sweet Grass
Daniels	Richland	Toole
Dawson	Roosevelt	Wibaux
Fergus	Sheridan	

Contacts will be made as usual with the officials in those counties that have not been re-inventoried as well as officials of the other road building agencies and the incorporated cities.

Estimated Costs:

Programmed 1970 FY	\$30,000
Estimated Expenditures 1970 FY	35,000
Estimated Cost 1971 FY	40,000

ROAD INVENTORY (Con'd.)

Bridge Records for Defense Requirements (Volume 2 Chapter III)
Item P-3

Objectives:

To provide current bridge information on an annual basis to the Bureau of Public Roads and the Defense Department on selected routes that may be used for military traffic.

A secondary objective of this study is to provide our Bridge and Maintenance Divisions with current information on all bridges on the Federal Aid Systems.

Accomplishments 1970 FY:

The Bridge Records for Defense Requirements and the Planning Survey Bridge Listing reports were revised to reflect changes due to construction, addition of routes, etc. Revised reports as of December 31, 1969 were printed and distributed.

Proposed Activities 1971 FY:

Field inspections of all structures on the Federal Aid System will be made during the fall and winter of 1970. These inspections have been made on a biennial basis for the past several years. The annual Bridge Records for Defense and the Planning Survey Bridge Listing reports will be compiled after the field inspections have been made.

Estimated Costs:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	6,000
Estimated Cost 1971 FY	25,000

ROAD INVENTORY (Cont'd)

Railroad Crossing Hazard Ratings (Volume 2 Chapter IV)
Item P-4

Objectives:

To inventory and establish hazard ratings on all railroad crossings on the Federal Aid System.

Accomplishments 1970 FY:

Hazard ratings were established on all crossings on the Federal Aid Systems. Data gathered by field inventory in 1968 was computerized and a report showing existing conditions on all crossings was published. Some work was also done on establishing warrants for various types of grade crossing protection.

Proposed Activities 1971 FY:

The recent merger of the Northern Pacific, Great Northern and the Burlington Railways into the Burlington Northern Railway has resulted in a general change of train movements within the State. It has therefor been decided to postpone any revisions on train movements until a more normal type operation is apparent.

An update on vehicular traffic and improvement or changes in types of protection will be done. Revised hazard ratings will be computed as necessary.

Estimated Cost:

Programmed 1970 FY	\$6,000
Estimated Expenditures 1970 FY	2,500
Estimated Cost 1971 FY	4,000

ROAD INVENTORY (Cont'd)

Photographic Inventory of Federal Aid System (Volume 2 Chapter 1)
Item P-5

Objectives:

To obtain one 35 mm photo every one hundredth of a mile in each direction on the Interstate, Primary and State maintained Secondary Systems. It is anticipated that these photos will be used extensively to locate hazardous roadway conditions, in inventorying encroachments on right-of-way and as an aid in inventorying traffic control devices.

Accomplishments 1970 FY:

Various types of camera equipment were evaluated and camera was purchased. Special parts for the camera were built and vehicle to be used was received. It is estimated that photographic equipment will be mounted and ready for field testing by April 15.

Proposed Activities 1971 FY:

Actual photographic inventory should be completed. Projectors will be purchased and copies of films made in sufficient quantities for use by various divisions of the Montana State Highway Commission.

Estimated Cost:

Programmed 1970 FY	\$25,000
Estimated Expenditures 1970 FY	20,000
Estimated Cost 1971 FY	30,000

MAPPING

Rural and General (Volume 3 Chapter I)
Item P-6

Objectives:

To produce and maintain a complete set of up-to-date county maps of the State on scales of 1" = 1 mile; $\frac{1}{2}$ " = 1 mile and $\frac{1}{4}$ " = 1 mile. Complete maps of counties that are currently being re-inventoried will be produced the following year after inventory by the scribing process.

Accomplishments 1970 FY:

The following eight counties were completely remapped by scribing methods.

Cascade	Golden Valley	Madison	Teton
Fallon	Liberty	Missoula	Wheatland

Maps of the remaining 48 counties were revised to reflect construction changes, changes in city limits, etc.

Proposed Activities 1971 FY:

The following counties will be completely remapped by scribing methods.

Broadwater	Hill	Powell
Chouteau	Lewis & Clark	Prairie
Gallatin	Meagher	Stillwater
		Toole

The remaining county maps will be revised to reflect construction changes as they are received from the various road building agencies.

Estimated Cost:

Programmed 1970 FY	\$35,000
Estimated Expenditures 1970 FY	40,000
Estimated Cost 1971 FY	40,000

MAPPING (con'd.)

State Maps (Volume 3 Chapter I)
Item P-7

Objectives:

To produce the State tourist map, State systems map and other State maps as necessary.

Accomplishments 1970 FY:

Changes for a complete, new 1970 tourist map were compiled and submitted to the printer. Revisions were made on the State systems map and State maintenance map. A State map was also produced to aid in the coordination of all Federal Programs for fiscal year 1970.

Proposed Activities 1971 FY:

The program for next year will be similar to FY 1970.

Estimated Cost:

Programmed 1970 FY	\$6,000
Estimated Expenditures 1970 FY	5,500
Estimated Cost 1971 FY	6,000

MAPPING (Con'd.)

Mapping - Urban (Volume 3 Chapter II)
Item P-8 Incorporated City Plats

Objectives:

To produce and maintain a complete set of up-to-date plats for all of the 126 incorporated cities in Montana and to publish a city plat book every two years of all city plats and corresponding aerial photography.

Accomplishments 1970 FY:

All city plats have been revised to reflect changes in incorporated limits, street construction and changes in the Federal Aid System. Nine city plats were completely redrawn. New aerial photography was obtained for 25 larger cities. City plat book was published and distributed.

Proposed Activities:

All city plats will be updated as necessary, but the city plat book will not be published.

Estimated Cost:

Programmed 1970 FY	\$7,000
Estimated Expenditures 1970 FY	7,000
Estimated Cost 1971 FY	4,000

MAPPING (Con'd.)

City Photography
Item P-9

Objectives:

To provide current aerial photography for all cities in the State as required for advanced city planning.

Accomplishments 1970 FY:

Current photography was obtained for 25 of the larger cities in connection with the Functional Classification Study. These photos are included in the City Plat Book and are being used in advanced planning as well as the "TOPICS" program.

Proposed Activities 1971 FY:

Cities and urban areas will be photographed as required for advanced city planning, the TOPICS Program, etc.

Estimated Cost:

Programmed 1970 FY.	\$2,000
Estimated Expenditures 1970 FY	2,000
Estimated Cost 1971 FY	2,000

MAPPING (Con'd.)

Special Mapping (Volume 3 Chapter III)
Item P-10

Objectives:

To produce special maps for specific purposes such as maps for weekly road report, maps showing restrictive clearances on structures, land use maps, accident spot maps, etc.

Accomplishments 1970 FY:

Monthly spot accident map was produced and maintenance map showing detour sections and road conditions was revised as required. Maps showing sufficiency ratings by financial districts were produced for sufficiency report.

Proposed Activities 1971 FY:

The proposed program will be substantially the same as 1970.

Estimated Cost:

Programmed 1970 FY	\$3,000
Estimated Expenditures 1970 FY	2,500
Estimated Cost 1971 FY	3,000

MAPPING (Con'd.)

Photogrametric Mapping (Volume 3 Chapter III)
Item P-10A

Objectives:

To provide aerial photography and some photogrametric maps of portions of the Primary System to be used in advanced planning.

Accomplishments 1970 FY:

None. This will be a new project in FY 1971.

Proposed Activities 1971 FY:

To obtain aerial photography of a suitable scale for photogrametric mapping on portions of the FA Primary System where no recent photography exists. Photos and maps will be used in advance planning of road and bridge locations.

Estimated Cost:

Programmed 1970 FY	None
Estimated Expenditures 1970 FY	None
Estimated Cost 1971 FY	\$15,000

TRAFFIC

Traffic Counting (Volume 4 Chapter I, II & VII)
Item P-11 Volume and Vehicle Classification Counts

Objectives:

To obtain current traffic volume data on all important highways and streets on a sampling basis. Data collected are used in the location and design of highways and for any other purpose requiring traffic data.

Accomplishment 1970 FY:

Current vehicle mile estimates were made on all rural sections of the Federal Aid Systems. Traffic data were obtained on the urban extensions of the FA Systems in 32 cities. Blanket counts were made on all important streets and along screen lines in Helena and Miles City.

The annual Traffic by Sections report was published as well as traffic flow maps of the FAP and FAS systems for 1968.

Traffic volumes and projections were made at several hundred locations for the Preconstruction Division.

Ten hourly recording and ten non-recording portable counters were purchased and all portable counters were maintained in proper operating condition.

The following is a listing of the approximate number and type of regularly scheduled counts taken during FY 1970.

	<u>Rural</u>	<u>Urban</u>
Machine Counts	4,300	750
Manual- Turning Movement Counts	<u>550</u>	<u>-</u>
TOTAL	4,850	750

Proposed Activities 1971 FY:

Our regular traffic counting program will be similar to FY 1970 with the exception that more emphasis will be placed on counting traffic on county roads.

Item P-11 (Con'd.)

Vehicle mile estimates will be made for all systems and the annual Traffic By Section report will be prepared. Traffic flow maps of the Primary and Secondary Systems will also be prepared for 1970. Count locations will be tied to mileposts in order that traffic data may be stored and manipulated in the Planning Survey Data Bank.

It is estimated that about 12 portable counters will be purchased to replace those that were stolen, damaged or worn out beyond repair during the last year.

Estimated Cost:

Programmed 1970 FY	\$100,000
Estimated Expenditures 1970 FY	95,000
Estimated Cost 1971 FY	100,000

TRAFFIC (Cont'd)

Traffic Counting (Volume 4 Chapter I, II and VII)
Item P-12 Permanent Traffic Recorders

Objectives:

To obtain accurate hourly traffic patterns at various locations throughout the State for use in developing expansion factors for short counts, design hour volume data and traffic volume trends.

Accomplishments 1970 FY:

The operation and analysis of data collected at 41 locations throughout the State. Monthly and annual reports and a report on the design hourly volumes at each location were published.

Six machines were converted from magnetic to loop detection and approximately 250 maintenance service calls were made.

Proposed Activities 1971 FY:

The operation and data analysis of 41 permanent traffic recorders including monthly and annual reports and design hour tabulations.

Six machines will be converted from magnetic to loop detection at an approximate cost of \$200 each and regular maintenance will be continued on all counters.

Estimated Cost:

Programmed 1970 FY	\$20,000
Estimated Expenditures 1970 FY	20,000
Estimated Cost 1971 FY	20,000

TRAFFIC (Con'd.)

Vehicle Weight & Characteristics (Volume 4 Chapter III)
Loadometer Survey
Item P-13

Objectives:

To secure information on truck loading trends to be used in design and in developing truck regulations.

Accomplishments 1970 FY:

Truck weight data and other data on vehicle characteristics were collected at seven stations on the Rural Interstate System, four stations on rural Primary System, one station on urban Primary System and eight stations on rural Secondary System. Trucks were weighed for a 16 hour period from 6a - 10p at 19 locations and for a 24 hour period at one location on the Interstate System. All truck weight data were coded for IBM processing. Cards were punched, edited and submitted to the Bureau of Public Roads for tabulating.

Proposed Activities 1971 FY:

Data will be collected at the same 20 locations as usual as prescribed by the latest directive from the Bureau of Public Roads.

Estimated Cost:

Programmed 1970 FY	\$20,000
Estimated Expenditures 1970 FY	17,000
Estimated Cost 1971 FY	18,000

TRAFFIC (Con'd.)

Weighing Facilities
Item P-14

Objectives:

To provide adequate truck weighing facilities for Planning, Research and enforcement at selected locations on the Interstate System.

Accomplishments 1970 FY:

A dual weighing facility was completed on I-15 west of Butte. A dual facility was let to contract on I-90 near Frenchtown and a single facility was let to contract on I-15 south of Great Falls.

Proposed Activities 1971 FY:

It is planned to participate in the cost of eligible items in the two facilities now under contract. A single facility on I-15 north of Helena may be let to contract during the next fiscal year.

Estimated Cost:

Programmed 1970 FY	\$60,000
Estimated Expenditures 1970 FY	30,000
Estimated Cost 1971 FY	50,000

TRAFFIC (Con'd.)

Origin & Destination Studies - Rural (Volume 4 Chapter VI)
Item P-15

Objectives:

To obtain factual data on current use of highways in relation to the origin and destination of trips. These data will be used in the location of new routes or relocation of existing routes.

Accomplishments 1970 FY:

This is a new item in the work program for 1971 FY. Two small origin and destination studies were made during FY 1970 in connection with interchange locations, but both of these studies were charged to PE projects.

Proposed Activities 1971 FY:

It is proposed to make an external origin and destination study of traffic in the vicinities of Libby and Conrad in cooperation with comprehensive plans financed by HUD. It is also proposed to make an origin and destination study on Montana 16 between Sidney and Fairview in connection with a possible route relocation.

Estimated Cost:

Programmed 1970 FY	-
Estimated Expenditures 1970 FY	-
Estimated Cost 1971 FY	\$10,000

TRAFFIC (Con'd.)

Special Traffic Studies (Volume 4 Chapter VIII)
Item P-16

• Objectives:

To provide whatever traffic data is required for special purposes by the highway planner or administrator.

Accomplishments 1970 FY:

Approximately 110 special turning movement counts were taken manually during peak hours at road and street intersections throughout the State. There were also 20 small traffic studies made to solve specific problems in small cities.

Proposed Activities 1971 FY:

It is planned to provide necessary traffic information as required throughout the year for special situations.

Estimated Cost:

Programmed 1970 FY	\$20,000
Estimated Expenditures 1970 FY	18,000
Estimated Cost 1971 FY	20,000

HIGHWAY STATISTICS

Mileage (Volume 5 Chapter 1)

Item P-17 - Road Log, State and Local Mileage Tables

Objectives:

To provide factual information on the extent of the physical highway plant and trends in system development, system improvement and rates of progress.

Accomplishments 1970 FY:

A Federal Aid Road Log showing the current status of all construction on the State systems was compiled and published.

State mileage tables which show the status of each system at the beginning of the year, the changes that have occurred during the year and the status at the end of the year were compiled and distributed.

Local mileage tables showing essentially the same information as the State mileage tables were also compiled and published.

Proposed Activities 1971 FY:

It is anticipated that the activities will be substantially the same in 1971 FY. The format of the Road Log will probably be changed to conform with output from the data bank and to facilitate printing by computer.

Estimated Cost:

Programmed 1970 FY	\$27,000
Estimated Expenditures 1970 FY	25,000
Estimated Cost 1971 FY	25,000

HIGHWAY STATISTICS (Con'd.)

Motor Vehicles, Operators and Fuels (Volume 5 Chapter II)
Item P-18

Objectives:

To assemble statistics on Motor Vehicle registrations, Motor Vehicle Operators and fuel consumption to be used in determining highway user tax yields and vehicle and fuel tax policies.

Accomplishments 1970 FY:

Statistics on motor vehicle registrations and fuel consumption were compiled and reported on a monthly and annual basis. Statistics on motor vehicle operators were reported on an annual basis. An IBM file of licensed drivers has been compiled and will be used in future reports.

Proposed Activities 1971 FY:

Activities for 1971 FY will be approximately the same as last year.

Estimated Cost:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	4,000
Estimated Cost 1971 FY	4,000

HIGHWAY STATISTICS (Con'd.)

Truck and Bus Statistics
Item P-19

Objectives:

To provide current data on the number and type of trucks and buses registered by GVW class and type of fuel used.

Accomplishments 1970 FY:

Truck and bus registrations were coded and collated with GVW data as they were received from the Registrar's office. This is a cooperative project with the GVW Section. Data were used in preparing the PR-561 report and as an aid in administrative decisions at the State level.

Proposed Activities 1971 FY:

Activities will be substantially the same as in FY 1970.

Estimated Cost:

Programmed 1970 FY	\$3,000
Estimated Expenditures 1970	4,000
Extimated Cost 1971 FY	4,000

HIGHWAY STATISTICS (Con'd.)

State and Local Finance (Volume 5 Chapter III)
Item P-20

Objectives:

To obtain pertinent financial statistics on highway taxation and disbursements for highway purposes from State and local road building agencies.

Accomplishments 1970 FY:

Annual reports covering finances of State and local road building agencies were compiled and published. Statistical sampling methods were used in compiling financial data from cities and counties.

Proposed Activities 1971 FY:

Financial data for State and local road building agencies will be compiled and published as usual.

Estimated Cost:

Programmed 1970 FY	\$3,000
Estimated Expenditures 1970 FY	2,500
Estimated Cost 1971 FY	3,000

ECONOMIC AND FISCAL

Highway Investment and Road Life (Volume 6 Chapter IV)
Item P-21

Objectives:

To maintain an historical record of highway construction and costs and to compile data on the service life of various types of pavement.

Accomplishments 1970 FY:

Road life data was kept current as bids on projects were awarded. Tables RL 2, RL 3, RL 11A and RL 11B were compiled and submitted to the Bureau of Public Roads in response to a request for data on Service Life of Highway Pavements.

Proposed Activities 1971 FY:

It is planned to continue routine posting of project data to Road Life records, which will be used in compiling State mileage tables and the Road Log.

Estimated Cost:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	6,500
Estimated Cost 1971 FY	5,000

ECONOMIC AND FISCAL (Con'd.)

Straight Line Diagrams (Volume 6 Chapter IV)
Item P-22

Objectives:

To present a visual historical record of highway construction on a diagram showing all major features for all projects on the Federal Aid Systems.

Accomplishments 1970 FY:

Diagrams were revised to reflect changes due to new construction or maintenance betterments. A few of the older diagrams were completely redrawn. One draftsman has been assigned exclusively to this project.

Proposed Activities 1971 FY:

Diagrams will be revised to reflect latest construction as plans are received from the Construction Division. Older sheets will be redrawn as time permits.

Estimated Cost:

Programmed 1970 FY	\$8,000
Estimated Expenditures 1970 FY	5,000
Estimated Cost 1971 FY	8,000

ECONOMIC AND FISCAL (Con'd.)

Construction Cost Data and Cost Indexes (Volume 6 Chapter IV)
Item P-23

Objectives:

To provide detailed information on the unit costs and quantities of materials on all highway and bridge projects let to contract. Costs of specific items are then related to the same costs during a base period to compile a cost index for the State.

Accomplishments 1970 FY:

All highway and bridge contracts were analysed and an annual contract analysis report was compiled and published. Montana's Construction Cost Index was compiled and published on a semi-annual basis.

Proposed Activities 1971 FY:

Activity on this project will be substantially the same as in FY 1970. Some refinement will be made in the contract analysis computer program to provide more meaningful data for cost estimation.

Estimated Cost:

Programmed 1970 FY	\$4,000
Estimated Expenditures 1970 FY	3,500
Estimated Cost 1971 FY	4,000

ECONOMIC AND FISCAL (Cont'd)

Right-of-Way Studies Item P-24

Objectives:

To study the "Before and After" values of parcels of land remaining after portions of land have been acquired for right of way purposes. These studies will serve to document any damages that may be anticipated by the landowner after highway rights of way have been acquired.

Accomplishments 1970 FY:

This study, under the supervision of the Right of Way Division has not shown too much progress due to lack of trained personnel. An experienced person has now been hired to supervise the study.

Proposed Activities 1971 FY:

It is anticipated that case histories on several parcels of land will be compiled and a report published on each parcel.

Estimated Cost:

Programmed 1970 FY	\$18,000
Estimated Expenditures 1970 FY	5,000
Estimated Cost 1971 FY	20,000

ECONOMIC AND FISCAL (Con'd.)

Traffic Corridor Study
Item P-25

Objectives:

To provide factual information concerning the economic effects of bypassing several small communities by the construction of I-90 between Three Forks and Bozeman.

Accomplishments 1970 FY:

This study is being conducted by the Bureau of Business and Economic Research of the University of Montana. The "Before" phase was conducted in 1967 before I-90 was open to traffic. All available economic indicators were investigated in Three Forks, Logan, Manhattan and Belgrade. An origin and destination study of traffic using U.S. 10 was also made to determine stops in these communities.

Proposed Activities 1971 FY:

Personnel from the University of Montana plan to investigate the same economic indicators in the "After" study that were used in 1967. Origin and destination studies on both I-90 and U.S. 10 will be made by the State. All available data will be analysed by the Bureau of Business and Economic Research and a final report will be prepared. A detailed prospectus of the "After Phase" will be submitted.

Estimated Cost:

Programmed 1970 FY	-
Estimated Expenditures 1970 FY	-
Estimated Cost 1971 FY	\$18,000

SYSTEM AND PROGRAMMING

Traffic Operation Plans (Volume 7
Item P-26

Objectives:

To develop comprehensive traffic operation plans in cities of over 5,000 population in cooperation with the local jurisdictions. These plans will result in highway improvements designed specifically to reduce traffic congestion on a systematic basis over a network of arterial streets throughout the urban areas.

Accomplishments 1970 FY:

A consultant has been engaged to develop a Traffic Operation Plan for Great Falls in cooperation with the State, city and city-county planning board. Work is progressing satisfactorily.

The Planning Survey Section in cooperation with the city and city-county planning board is in the process of developing a plan for the Billings urban area. The plan has been developed to a point where priorities are apparent.

Proposed Activities 1971 FY:

Traffic Operation Plans for both Billings and Great Falls will be completed. A plan for Missoula will be started by the Planning Survey Section or a consultant. External origin and destination studies will be made in Libby and Conrad for immediate use in HUD comprehensive planning and for later use in Traffic Operations Plans for these smaller cities.

Estimated Cost:

Programmed 1970 FY	\$70,000
Estimated Expenditures 1970 FY	65,000
Estimated Cost 1971 FY	50,000

SYSTEMS AND PROGRAMMING (Con'd.)

Continuing Needs Estimate (Volume 7 Chapter II)
Item P-27

Objectives:

To establish a continuing highway needs study which will provide an accurate and immediately available estimate of engineering needs on the Interstate and Primary Systems for planning, programming and budgeting purposes.

Accomplishments 1970 FY:

One professional engineer has been hired to head the Continuing Needs Section and the Advanced Planning Section of the Washington Highway Department was visited to obtain ideas on updating procedures. It appears that some of Washington State's procedures and IBM programs can be used.

Proposed Activities 1971 FY:

A system of updating estimates by IBM procedures will be developed. One person from the Needs Estimate Section will work with the consultant in the 1990 Classification and Needs Estimate Study, so that he will become familiar with methods used in estimating future needs. If time permits, the 1966 Study of Needs on the Primary System will be updated.

Estimated Cost:

Programmed 1970 FY	\$35,000
Estimated Expenditures 1970 FY	37,000
Estimated Cost 1971 FY	35,000

SYSTEM AND PROGRAMMING (Con'd.)

Sufficiency Ratings (Volume 7 Chapter II)
Item P-28

Objectives:

To obtain factual data on the relative sufficiency of the FA Primary System for use in allocating construction funds and in long range priority planning.

Accomplishments 1970 FY:

A field inspection was made of the entire Primary System. Foundation, drainage and surfacing on each section were rated in the field by a point system. Other factors such as traffic capacity and safety were added to a formula which determined the relative sufficiency and the equivalent deficient mileage on each section. The equivalent deficient mileage is used to allocate state construction funds to the financial districts. An annual report was published which is used extensively in long range planning.

Proposed Activities 1971 FY:

Activities will be substantially the same in FY 1971.

Estimated Cost:

Programmed 1970 FY	\$18,000
Estimated Expenditures 1970 FY	18,000
Estimated Cost 1971 FY	18,000

SYSTEM AND PROGRAMMING

Project Control and Programming (Volume 7 Chapter III)
Item P-29

Objectives:

To establish and maintain a realistic five year construction program for the FA Systems and to schedule projects for contract in an orderly manner.

Accomplishments 1970 FY:

A long range planning section was established and a tentative five year construction program was produced. Some work was done in the investigation of methods used in scheduling projects in other states.

Proposed Activities 1971 FY:

It is planned to continue work on long range programming and scheduling. The Sufficiency Rating Study and the Needs Estimate will be used to the fullest extent possible and some type of simplified critical path method of scheduling projects for contract will be developed.

Estimated Cost:

Programmed 1970 FY	\$20,000
Estimated Expenditures 1970 FY	25,000
Estimated Cost 1971 FY	25,000

URBAN TRANSPORTATION PLANNING

Continuing Planning - Billings (Volume 8
Item P-30

Objectives:

To develop and maintain an effective program for continuing transportation planning in the Billings urban area in cooperation with the local jurisdictions. This continuing planning process will be responsive to the changes in needs of the community as evidenced by changes in land use, travel patterns, etc. Current data concerning land use, travel and transportation facilities will be maintained to allow periodic reevaluation of the transportation plan as conditions change from those initially analysed and forecast.

Accomplishments 1970 FY:

The Billings Transportation Plan Update was completed and the report published in 1969. Members of the Billings City-County Planning Board and city officials were contacted by State and Bureau of Public Roads representatives concerning the establishment of a continuing transportation planning organization in cooperation with the State. The areas of responsibility in the planning process have been defined and tentative agreements have been negotiated.

Proposed Activities 1971 FY:

Due to the fact that the update plan was published and released during the fiscal year of 1970, it is anticipated that activities and expenditures will be minimal during the coming year.

A formal operations plan will be prepared in cooperation with existing technical and policy committees and will be submitted to the City-County Planning Board and the Bureau of Public Roads for final approval.

The City-County Planning Board will update land use data and population estimates under a HUD 701 Grant at an estimated cost of \$7,000.

P-30 Continued

The State will take traffic counts at strategic locations throughout the urban area to determine changes in traffic patterns and will analyse all current data to determine if trends are following forecasts. All available data will be assembled for publishing an interim report.

Estimated Cost:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	2,000
Estimated Cost 1971 FY	5,000

URBAN TRANSPORTATION PLANNING (Cont'd)

Continuing Planning - Great Falls
Item P-31

Objectives:

To develop and maintain an effective program for continuing transportation planning in the Great Falls urban area in cooperation with the local jurisdictions. This continuing planning process will be responsive to the changes in needs of the community as evidenced by changes in land use, travel patterns, etc. Current data concerning land use, travel and transportation facilities will be maintained to allow periodic reevaluation of the transportation plan as conditions change from those initially analysed and forecast.

Accomplishments 1970 FY:

The Great Falls Transportation Plan Update was completed and a report published in 1970. Members of the Great Falls City-County Planning Board and city officials were contacted concerning the continuing planning processes. Tentative agreements were reached and the areas of responsibilities defined between the State and local governmental agencies.

Proposed Activities 1971 FY:

The final report on the Great Falls Transportation Update Study will be released in June 1970. Expenditures for continuing planning will therefor be at a minimum rate for FY 1971.

A formal operations plan will be prepared in cooperation with existing technical and policy committees. This plan will be submitted to the City-County Planning Board and the Bureau of Public Roads for approval.

Under the tentative agreements with local jurisdictions, the City-County Planning Board will be responsible for updating land use data and population estimates at an

Item P-31 Continued.

estimated cost of approximately \$5,000 per year.

The State will be responsible for traffic counting and analyzing current data to determine whether forecasts are being followed. An interim report will be published in FY 1972.

Estimated Cost:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	2,000
Estimated Cost 1971 FY	5,000

URBAN TRANSPORTATION PLANNING (Con'd.)

Helena Urban Transportation Study
Item P-32

Objectives:

To develop a comprehensive transportation plan for the Helena urban area in cooperation with the local governmental agencies and in accordance with the procedures outlined in PPM 50-9 modified to fit smaller urban area requirements.

Accomplishments 1970 FY:

Travel inventories: A home interview survey, truck and taxi survey and external survey have been completed including the necessary coding and checking.

Traffic inventories: screenline counts, cordon counts, counts of major street intersections and speed and delay studies have been completed.

Trip tables and trip generation factors have been developed and are ready for traffic assignment.

Land use data and population projections have been prepared by the local governments and are also ready for introduction into the traffic assignment process.

Proposed Activities 1971 FY:

Travel models are expected to be developed for the existing plus committed system utilizing the 360 traffic assignment battery. Future economic activity, population growth and land use will be forecast in cooperation with the local governments in order to provide trip generation and distribution for the forecast year. A transportation system will be selected on the basis of the forecast data and system analysis. The plan is expected to be essentially complete by the end of this period.

Estimated Cost:

Programmed 1970 FY	\$40,000
Estimated Expenditures 1970 FY	30,000
Estimated Cost 1971 FY	35,000

URBAN TRANSPORTATION PLANNING (Con'd.)

Miles City Urban Transportation Study
Item P-33

Objectives:

To develop a comprehensive transportation plan for the Miles City urban area in cooperation with the local governmental agencies and in accordance with the procedures outlined in PPM 50-9 as modified to fit smaller urban area requirements.

Accomplishments 1970 FY:

The study area has been zoned and all necessary traffic volume and intersection counts made. All travel inventories, including truck and taxi and the external survey have been completed. The home interview survey was based on a 1 in 5 sample involving approximately 650 dwelling units.

All origin and destination data has been coded and some work on the land use and population projections has been completed.

Proposed Activities 1971 FY:

Since other agencies are involved in the assimilation of data that must be utilized in the transportation planning process, it will be necessary to plan our activities accordingly.

It is expected that all land use and population data will be completed. Travel models should be developed on the existing plus committed systems by the end of this period and some work done on systems analysis.

It will be necessary to develop some phases of the Miles City Study in conjunction with the Helena Study due to the utilization of the 360 traffic assignment battery which may develop slowly due to unfamiliarity and necessary program adjustments.

Estimated Cost:

Programmed 1970 FY	\$20,000
Estimated Expenditures 1970 FY	20,000
Estimated Cost 1971 FY	25,000

URBAN TRANSPORTATION PLANNING (Con'd.)

Butte Urban Transportation Study
Item P-34

Objectives:

To develop a comprehensive transportation plan for the Butte urban area in cooperation with the local governmental agencies and in accordance with the procedures outlined in PPM 50-9 modified to fit smaller urban area requirements.

Accomplishments 1970 FY:

None. This will be a new work item for 1971 FY.

Proposed Activities 1971 FY:

Agreements concerning financial and project participation to be drawn and finalized between the Montana Highway Commission and the Butte-Silver Bow City-County Planning Board. It is proposed to start a transportation study this FY year on a cooperative basis, with the Planning Board responsible for items 1, 3, 8 and 10 in the 10 point cooperative planning process. The Planning Survey Section will be responsible for completion of the remaining items in the 10 point process. It is intended that this study will be made over a two year period, with fieldwork commencing early in the FY.

Estimated Cost:

Programmed 1970 FY	None
Estimated Expenditures 1970 FY	None
Estimated Cost 1971 FY	\$25,000

URBAN TRANSPORTATION PLANNING (Con'd.)

City Planning General
Item P-35

Objectives:

To conduct minor planning studies in smaller cities in order to provide answers to small specific problems not otherwise covered in major urban transportation studies.

Accomplishments 1970 FY:

A small origin and destination survey was made at one station for city officials in Missoula as an aid in determining feasible routes for commercial vehicles. Traffic was counted at several locations in smaller cities to provide input data for comprehensive plans being developed under HUD funds and supervision.

Proposed Activities 1971 FY:

It is anticipated that the Planning Survey Section will work quite closely with State Planning Board and local officials to provide necessary traffic data as input for comprehensive plans now underway under the "701" HUD programs. More realistic plans should be developed under this cooperative program.

Estimated Cost:

Programmed 1970 FY	\$5,000
Estimated Expenditures 1970 FY	2,500
Estimated Cost 1971	3,000

SPEED AND TRAFFIC SERVICE STUDIES

Speed Studies (Volume 9 Chapter I)
Item P-36

Objectives:

To determine normal speed distributions and speed trends by vehicle type at selected locations throughout the State.

Accomplishments 1970 FY:

Speed studies were made at six locations on Interstate PTW and constructed Interstate throughout the State during May and August. Data were compiled and reports published on the results of these studies. Studies have been conducted at five of the six locations since 1942.

Proposed Activities 1971 FY:

It is planned to select two additional stations on the Federal Aid Primary System to provide additional coverage. Studies will be conducted in May and August as usual and reports will be compiled and distributed.

Estimated Cost:

Programmed 1970 FY	\$1,500
Estimated Expenditures 1970 FY	1,200
Estimated Cost 1971 FY	1,500

SPEED AND TRAFFIC SERVICE STUDIES (Cont'd)

Accident Studies (Volume 9 Chapter II)
Item P-37

Objectives:

To provide factual data on the location, number and type of traffic accidents to other divisions of the Montana Highway Commission and the general public. These data are used in identifying high accident locations and in designing improvements at these locations.

Accomplishments 1970 FY:

All reported accidents were coded and tabulated by IBM methods. The annual Accident by Section Report was compiled and distributed. Requests from the Traffic Engineer's office for special accident data were filled and locations of all accidents were spotted on straight line diagrams.

Purposed Activities 1971 FY:

It is proposed to continue this activity in cooperation with the Montana Highway Patrol at about the same level as last year. A study of our present system of coding will be made to determine if it can be streamlined to provide more current data.

Estimated Cost:

Programmed 1970 FY	\$22,000
Estimated Expenditures 1970 FY	15,000
Estimated Cost 1971 FY	15,000

REFERENCE LIBRARY

Highway Library (Volume 10 Chapter I)
Item P-38

Objectives:

To provide ready reference material on subjects pertaining to various phases of highway planning, construction, operations and research.

Accomplishments 1970 FY:

Several hundred volumes of reference material were received from various sources and cataloged. An inventory of material by subject matter was compiled and distributed. The library was moved to larger quarters.

Proposed Activities 1971 FY:

The activities will be substantially the same as last year.

Estimated Cost:

Programmed 1970 FY	\$10,000
Estimated Expenditures 1970 FY	8,000
Estimated Cost 1971 FY	9,000

SPECIAL STUDIES

National Highway Functional Classification & Needs Study 1968 and 1990
(Volume 11 Chapter I)
Item P-39

Objectives:

To classify all roads and streets within the State into functional classes according to projected traffic volumes and characteristics in 1968 and 1990 and to estimate the needs of each functional class. Study to be made in accordance with subject manual dated February 1970.

Accomplishments 1970 FY:

All roads and streets within the State were classified as to function on December 31, 1968 in accordance with instructions contained in the Functional Classification Manual dated April 1969.

Present classified systems were revised to reflect 1990 conditions and sampling procedures were developed to estimate needs on each system in accordance with procedures detailed in the 1990 Classification and Needs Estimate Manual.

Proposed Activities 1971 FY:

The 1990 estimate of needs by system will be completed and a final report on the Classification and Needs Study will be prepared by the target date of April 1, 1971.

Estimated Cost:

Programmed 1970 FY	\$130,000
Estimated Expenditures 1970 FY	190,000
Estimated Cost 1971 FY	237,000

SPECIAL STUDIES (Con'd.)

Other Special Studies
Item P-40

Objectives:

To cover the cost of any studies that may be requested to provide answers to specific questions posed by Congress, the State Legislature or the Montana Highway Commission.

Accomplishments 1970 FY:

The Interstate Status Development Study and Rest Area Study were funded under this item.

PR-511 diagrams showing the status of the Interstate System were revised periodically and distributed.

A study was made of usage of one rest area on I-90 near Homestake Pass east of Butte.

Proposed Activities 1971 FY:

The same two studies will be continued in addition to any special studies that may be requested during the year.

Estimated Cost:

Programmed 1970 FY	\$10,000
Estimated Expenditures 1970 FY	5,000
Estimated Cost 1971 FY	10,000

SPECIAL STUDIES (Con'd)

Interstate Cost Estimate
Item P-41

Objectives:

To provide Congress and state officials with an accurate estimate of the cost of completing the Interstate System in Montana. This estimate will be used in the allocation of funds at both the Federal and state levels.

Accomplishments 1970 FY:

The 1970 Interstate System Cost Estimate was compiled and submitted to the Bureau of Public Roads by the deadline date of March 1, 1970.

Proposed Activities 1971 FY:

The 1972 Interstate Cost Estimate will be compiled by July 1, 1971. A computer program will be developed to update the 1970 estimate to 1972 conditions.

Estimated Cost:

Programmed 1970 FY	\$35,000
Estimated Expenditures 1970 FY	20,000
Estimated Costs 1971 FY	20,000

SPECIAL STUDIES (Con'd.)

Planning Survey Data Bank
Item P-42

Objectives:

To develop a computerized system of storage and retrieval of data contained in FA Road Log, Traffic by Sections Report and other reports prepared and published by Planning Survey Section.

Accomplishments 1970 FY:

A system of storage and retrieval for Road Log and traffic data has been developed under a contract with Montana State University. Summaries and final reports are printed by computer.

The system that has been developed provides means of updating and may be expanded to store and retrieve other Planning Survey data.

Proposed Activities 1971 FY:

It is planned to continue this project in order to include accident data, Sufficiency Ratings, Bridge Listings, etc. Some work will also be done on retrieval of data by remote control consoles. A prospectus and work plan for the additional phase will be submitted.

Estimated Cost:

Programmed 1970 FY	\$25,000
Estimated Expenditures 1970 FY.	12,000
Estimated Cost 1971 FY	20,000

SUMMARY OF PLANNING ACTIVITIES - PART I
FOR PROJECT HPR-1(9)
JULY 1, 1970 TO JUNE 1, 1971

ITEM NO	PROJECT NAME	ESTIMATED COST \$
P-1	Undistributed Overhead - Participating	37,000
P-2	Road Inventory	40,000
P-3	Bridge Records	25,000
P-4	Railroad Crossing Hazard Ratings	4,000
P-5	Photographic Inventory of FA System	30,000
P-6	Rural and General Mapping	40,000
P-7	State Maps	6,000
P-8	Incorporated City Plats	4,000
P-9	City Photography	2,000
P-10	Special Mapping	3,000
P-10A	Photogrametric Mapping	15,000
P-11	Volume & Vehicle Classification Counts	100,000
P-12	Permanent Traffic Recorders	20,000
P-13	Loadometer Survey	18,000
P-14	Weighing Facilities	50,000
P-15	Origin & Destination Studies - Rural	10,000
P-16	Special Traffic Studies	20,000
P-17	Road Log, State & Local Mileage Tables	25,000
P-18	Motor Vehicles, Operators and Fuels	4,000
P-19	Truck and Bus Statistics	4,000
P-20	State and Local Finance	3,000
P-21	Highway Investment and Road Life	5,000
P-22	Straight Line Diagrams	8,000
P-23	Construction Cost Data and Cost Indexes	4,000
P-24	Right-of-Way Studies	20,000
P-25	Traffic Corridor Study	18,000
P-26	Traffic Operation Plans	50,000
P-27	Continuing Needs Estimate	35,000
P-28	Sufficiency Ratings	18,000
P-29	Project Control and Programming	25,000
P-30	Continuing Planning - Billings	5,000
P-31	Continuing Planning - Great Falls	5,000
P-32	Helena Urban Transportation	35,000
P-33	Miles City Urban Transportation Study	25,000
P-34	Butte Urban Transportation Study	25,000
P-35	City Planning General	3,000
P-36	Speed Studies	1,500
P-37	Accident Studies	15,000
P-38	Highway Library	9,000
P-39	Functional Classification Study & Needs Estimate	237,000
P-40	Other Special Studies	10,000
P-41	1971 Interstate Estimate	20,000
P-42	Planning Survey Data Bank	20,000
TOTAL PLANNING ACTIVITIES - PART I		\$ 1,053,500

STATE OF MONTANA

HPR 1 (9)

WORK PROGRAM

1971 FISCAL YEAR

PART II

RESEARCH & DEVELOPMENT

ESTIMATE OF ACTIVITIES AND
EXPENDITURES OF PLANNING SURVEY SECTION
FOR THE PERIOD OF JULY 1, 1970 - JUNE 30, 1971

HPR-1(9)

PART II - RESEARCH & DEVELOPMENT

Type A - CONTINUING STUDIES

Item R-1 - Undistributed Overhead Research

Objectives:

To finance work program management and administration activities related to research activities.

Accomplishments 1970 FY:

1. The research engineer made frequent visits to review studies with the project leaders. Two studies were closed out and four studies have their final report completed or near completion. Seven new studies have been reviewed, proposals written and four are in various stages of approval. Three are already approved.

2. The Standard Contract was rewritten and submitted to the Bureau of Public Roads for approval.

3. Reviewed many HRIS, BPR and NCHRP reports or abstracts to bring their contents to the attention of Montana Highway Department personnel who have responsibilities in the area covered.

4. Attended the annual meeting of the Highway Research Board in Washington, D.C.

Proposed Activities 1971 FY:

A continuation of effort in the four area mentioned above along with:

1. Writing standard procedures and designing forms for submittal of research ideas to the research committee.

2. Design a better method of evaluating research projects if possible.

3. Attend Bureau of Public Roads Regional Workshop as well as the annual H.R.B. meeting.

Estimated Costs:

Programmed 1970 FY	\$18,000
Estimated Expenditures 1970 FY	15,000
Estimated Costs 1971 FY	18,000

Type A - CONTINUING STUDIES

Item R-2 - Subscription Highway Research Correlation Service

Objectives:

To correlate local research effort with nationwide activity to decrease duplication and increase knowledge in a research study.

Accomplishments 1970 FY:

1. Continued to catalog research reports in the Montana State Highway Commission library.

2. Received literature from the computer stored abstracts on numerous searches for research material.

Proposed Activities 1971 FY:

A continuation of the above program.

Estimated Cost:

Programmed 1970 FY	\$14,500
Estimated Expenditures 1970 FY	16,500
Estimated Expenditures 1971 FY	16,500

Type A - CONTINUING STUDIES
Item R-3 - Drainage Area Flow

U. S. Geological Survey - Yearly contract renewed in June.

Objectives:

To record the peak flows and frequency of floods in 151 drainage basins with less total area than 100 square miles. To publish a report of annual peak discharges from the data collected.

Accomplishments 1970 FY:

1. All gauging stations were read and maintained east of the Continental Divide. West of the Divide, all gauges were left in place, but not maintained. A decision will soon be made whether or not longer records are needed where maximum runoff is caused mostly by snow melt and are not as susceptible to flash floods from summer storms.

2. The annual report was published and some statistical analysis was done to determine the degree of confidence that could be placed on the projected twenty-five and fifty year flood frequency given the length of record and the variance of the data collected.

One result of the analysis is that 10 years of record seems to be minimum for projecting or interpolation to other non-gauged streams.

Proposed Activities 1971 FY:

1. To continue reading and maintaining approximately 150 stations and to produce the annual report.

2. Our drainage correlation study has found that certain groups of crest-gauging stations are recording information from the same statistical population. In other words, the same storm is being recorded by more than one station. By further analysis, some gauging stations can be removed without loss of significant information.

3. Continued analysis of statistical test to determine economical length of record and the confidence limits that can be placed on the interpolation of existing records.

4. To produce a report showing the flood frequency relationships for all regions west of the Continental Divide.

Estimated Cost:

Programmed 1970 FY	\$20,400
Estimated Expenditures 1970 FY	20,400
Estimated Cost 1971 FY	21,500

Type A - Continuing Studies
Item R-3A - Drainage Correlation Study

Montana State University Contract Approved August 1963

Objectives:

1. To gather data on the precipitation from the U.S. Weather Bureau and correlate this data with flood frequency data on the 200 U. S. Geological Survey crest gaging stations.
2. To study in depth on four small drainage areas twenty-nine different characteristics to determine what significance each has to the runoff recorded by research instruments. Some of these parameters studied included area, slope, vegetation, soil type, shape, direction of stream flow, elevation, temperature, wind speed and direction, precipitation intensity and amount, etc.
3. To compare collected data on runoff amounts with the various predicting techniques proposed in hydraulic literature to determine if one seemed superior to all others for Montana.
4. To determine what confidence limits could be placed on data projected for a given flood frequency and a given period of record.

Accomplishments 1970 FY:

The past year has been spent analyzing data on the computer to determine the correlations of the various parameters and to gather together the data graphs and illustrations for the final report.

Proposed Activities 1971 FY:

The final report is being written and will be complete by September 30, 1970.

Estimated Costs:

Programmed 1970 FY	\$15,000
Estimated Expenditures 1970 FY	16,200
Estimated Costs 1971 FY	6,000
Estimated Costs to Date 6/30/70	\$194,000

Type A - NEW STUDIES
Item - R-4 - Hydrologic & Hydraulic Research

Montana State University proposal approved May 1970.

Objectives:

To write a comprehensive engineering report which will recommend engineering methods for:

1. predicting the magnitude and frequency of peak flows.
2. gathering the required field and related data for hydraulic structure design.
3. Selecting proper culvert sizes to accomodate flood waters.

Proposed Activities 1971 FY:

The study will be concentrated on the hydrologic portion of the report first. A literature review will be conducted to determine the twenty five and fifty year flood that will fit Montana's diverse topographic and climate conditions. Maps, hydrologic graphs and other related information will be prepared for the report.

Estimated Costs:

Estimated Cost 1971 FY

\$18,350

Type A - NEW STUDIES

Item - R-5 - Procedures & Materials for Roadside Development

Montana State University proposal submitted May 1970 for five year study.

Objectives:

This is a multi-objective study to advance the knowledge of the following:

1. Dryland planting relative to deep rooted "tube" plants, soil moisture condensation traps and interconnection root transplants.
2. Vegetative species capable of providing satisfactory cover on subsoils without major modifications such as topsoiling, or of fast growing species which can anchor topsoil to subsoils until grass cover can be established.
3. Mechanical aids, mulching materials and treatments to provide initial effective topsoil stabilization.
4. Machinery modifications which could do a more effective job of preparing seed beds, seeding and mulching on steep highway slopes.

Accomplishments 1970 FY:

This project is scheduled to begin July 1, 1970. A previous five year project developed a number of significant ideas which will be further tested under the new contract. A comprehensive evaluation of planted area, of trees and shrubs planted in plastic basins and of deep rooted "tube" plants was conducted to get all the information possible for analysis and inclusion in the final report. Mr. Hodder, the project leader, prepared and delivered a paper at the 49th Annual Highway Research Board meeting in January on dry land plantings in Montana. He is completing his final report for the project.

Proposed Activities 1971 FY:

1. To make a literature review and evaluation of existing research.
2. To work on methods of topsoil stabilization and subsoil mechanical and vegetative anchorage.
3. To evaluate different techniques for seed bed preparation for native species of grasses, shrubs, etc.
4. To work on certain machinery changes to enable seeders and tractors to work on back slopes.

Estimated Cost:

Estimated Cost 1971 FY

\$49,600

Type A - NEW STUDIES

Item - R-6 - Design Management Research Project

Roy Jorgensen Associates, Inc., Proposal submitted April 1970.

Objectives:

To apply research techniques toward improving manpower utilization, work systems and total management systems of road design functions and to test the techniques in the Design Division of the Montana State Highway Commission.

Proposed Activities 1971 FY:

To conduct the research into current practices and to study manpower availability; to recommend changes and standardize work levels by range of difficulty, skills required and availability. To set up standardized procedures, plans and production schedules. To identify training program needs and outline the program. To develop a design manual stating objectives, outlining its purpose and content so our people can gather data or other information necessary to later write the complete manual. To test all changes and recommendations implemented to assure that the solutions are feasible and proper.

Estimated Cost:

Estimated Cost 1971 FY

\$56,100

Type B - CONTINUING STUDIES
Item - R-7 - Pavement Cracking in Montana

Montana State Highway Commission - Construction Division
Proposal and work plan approved October 1969.

Objective:

To determine the extent and type of flexible pavement cracking in Montana and isolate, if possible, the causes of cracking.

Accomplishments 1970 FY:

A library review of the subject was made to get an understanding of other research efforts, their findings and their methods for identifying and quantifying cracking. Then all the project construction records were searched for information on the type of materials used, mix required, supplier of bituminous materials, weather conditions at time of laying, temperature of mix, etc. Field work was started after the office review of records were complete for projects. Coding sheets were developed and trial runs made to gather field information on type, extent and seriousness of the cracking.

Proposed Activities 1971 FY:

And additional employee will be hired to gather the field data during the summer months. All plant mix projects will be visited to determine pavement defects such as rutting, surface irregularities or cracking.

After the field work is complete, the researcher plans to analyze the data for correlation between each parameter and the effect it might have on cracked or noncracked sections of pavement.

Estimated Cost:

Programmed 1970 FY	\$6,260
Estimated Expenditures 1970 FY	4,800
Estimated Cost 1971 FY	10,100

Type B - NEW STUDIES

Item - R-8 - Livestock and Vehicle Underpass

Work Plan approved October 1969

Montana State Highway Commission - Right-of-Way Division

Objective:

1. To determine the effective use of livestock underpasses of various designs and lengths.
2. To determine optimum machinery underpass designs for various types of typical farming operations.

Proposed Activities 1971 FY:

The effective start date is July 1, 1970 and completion date is June 30, 1971. Therefore, the study must accomplish its objectives in fiscal 1971.

A list of underpass installations will be made and a short training session with right of way personnel will be completed before property owners are contacted to gather information on their operation, use of the underpass and their thoughts on the adequacy of design or practicality of location relative to the existing physical and operational conditions.

Estimated Cost:

Estimated Cost 1971 FY

\$14,000

Type B - NEW STUDIES
Item - R-9 - Underground Utilities

Montana State University proposal and work plan approved April 1970

Objective:

To gather the latest available information on the feasibility of underground electrical transmission lines.

Proposed Activities 1971 FY:

The study will be complete in one fiscal year beginning July 1, 1970 and ending June 30, 1971. The work program will include the following:

1. Literature search
2. Survey of current practices of selected utilities
3. Comilation and evaluation of data
4. Establish realistic costs to place utilities underground

Estimated Cost:

Estimated Cost 1971 FY

\$14,200

CONTINGENCIES AND PROPOSED STUDIES
Item R-10

1. Channel Change Design Research (Type A) \$12,000

Montana State University will prepare a proposal for the study of river and stream meanders, current, volume, scour, partical size, etc., by means of a hydraulic model to learn how to design channel changes without ill effects both up and down stream from the channel change.

2. Wind Activated Automatic Signs \$30,000

This proposal was submitted as a research proposal, but will soon be resubmitted for an experimental project to erect warning signs in the Livingston and surrounding area to warn motorists of dangerously high winds when they exist.

3. Other Contingency Funds \$22,000

Estimated Cost 1971 FY \$70,000

MONTANA PROJECT HPR - 1 (9)
WORK PROGRAM - PART II
FISCAL YEAR 1971

LINE ITEM NO.	STATE STUDY NO.	STUDY TITLE	EST. COST 1971 YEAR	TYPE OF RESEARCH	W.O. CONTACT
TYPE A CONTINUING STUDIES					
R-1	8200	Undistributed Overhead Research	18,000		
R-2	8500	Subscription Highway Research			
		Correlation Service	16,500		
R-3	8519	Drainage Area Flow	21,500		
R-3A	7909	Drainage Correlation Research	6,000		
TYPE A NEW STUDIES - WORK PLAN APPROVED					
R-4	7919	Hydrologic & Hydraulic Research	18,350		
R-5	7918	Procedures & Materials for Roadside Development	49,600		
R-6		Design Management	56,100		
TYPE B CONTINUING STUDIES					
R-7	7917	Pavement Cracking In Montana	10,100		
TYPE B NEW STUDIES - WORK PLAN APPROVED					
R-8		Livestock & Vehicle Underpass	13,750		
R-9	7920	Underground Utilities	14,200		
R-10 CONTINGENCIES & PROPOSED STUDIES					
		Channel Change Research (Type A)	12,000		
		Wind Actuated Signs	30,000		
		Other	22,200		
TOTAL			\$ 288,300		
Code: USGS United States Geological Survey					
MSU Montana State University					
MHD Montana Highway Department					

STATE OF MONTANA

HPR 1 (9)

WORK PROGRAM

1971 FISCAL YEAR

PART III

NON-PARTICIPATING ITEMS

NP-1 Non-Participating Items

Objectives:

To cover the cost of rent and utilities for the Planning Survey Section in the Hustad Center.

Estimated Cost 1971 FY:

Rent	\$10,000
Electricity	1,800
Heat	500
Water	<u>100</u>
Total	\$12,400

SUMMARY OF COSTS

TOTAL OF 42 PLANNING ITEMS - PART I. \$1,053,500

TOTAL OF 10 RESEARCH ITEMS - PART II 288,300

Subtotal Participating Items . . \$1,341,800

NON-PARTICIPATING ITEMS - PART III 12,400

TOTAL. \$1,354,200

